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TWIN SOLUTIONS OF THE SINGULAR IMPULSIVE BOUNDARY VALUE PROBLEMS ON THE HALF-LINE

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Abstract. In this paper, the singular boundary value problems on the half line are considered. By virtue of the fixed point index theory, under different conditions, the paper presents some results on the existence of twin solutions for the singular impulsive boundary value problems on the half line.

Keywords.boundary value problems, impulses, singularity, cone, fixed point index.
AMS(MOS) Subject classifications: 34B15, 34A37

1.Introduction

Boundary value problems on the half line arise quite naturally in the study of radially symmetric solutions of nonlinear elliptic equations and there are many results in this area, see [1]-[5] for examples. On the other hand, the theory of impulsive differential equations has developed as an important area of investigations in the past few years (see[13], [14]). Recently, some authors discussed some impulsive differential equations on the half-line such as [6], [7], [8], [11], [14], and others considered the singular boundary value problems, see [14], [15]. Naturally, in this paper we discuss the singular impulsive boundary value problems on half-line. In [14], Xiyu Liu obtained some results on the existence of one solution of a singular boundary value problem by Tychonoff fixed point theorem, which is not suitable for the existence of multiple solutions. In [15], the Ravi P.Agarwal and Donal O'Regan obtained a result on the existence of twin solutions of a singular boundary value problem on bounded interval. But because of the influence of impulses and infinite interval, their methods are not applicable for the existence of multiple solutions of the singular impulsive boundary value problems on half line (defined in section 2 as Eq(2.1)). But from [15], we got an idea that it is possible to discuss the existence of multiple solutions of Eq(2.1).

In this paper, in order to surmount the difficulty coming from the singularity and impulses, first we construct a new special cone in Banach space C_l(defined in section 2) instead of the locally convex space in [14]. In section 3, we obtain a result(Theorem 3.1) on the existence of multiple solutions for Eq(2.1) under the condition that $f(t,x)$ is sup-linear in x at $+\infty$. Without